ISSN (print) 0093-4666 © 2014. Mycotaxon, Ltd. ISSN (online) 2154-8889

MYCOTAXON

http://dx.doi.org/10.5248/128.195

Volume 128, pp. 195–202 *April–June 2014*

A new slender species of *Aureoboletus* from southern China

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Abstract — *Aureoboletus tenuis* sp. nov. is described from Guangxi Province, China. It is characterized by slender basidiomes with a glutinous, wrinkled, and light brown or reddish-brown to dark brown pileus. LSU sequence analysis confirms placement of the new species in *Aureoboletus.* A colour plate showing fruitbodies in situ and illustrations of microscopic elements are provided.

Key word — *Basidiomycota*, *Boletales*, taxonomy

Introduction

Aureoboletus was circumscribed by Pouzar (1957) (with *A. gentilis* (Quél.) Pouzar as type species) based on the following morphological features: small to medium sized basidiomes, an often viscid (but sometimes subtomentose) pileus, golden yellow or bright yellow (even when dried) tubes and pores, and a subequal or fusoid viscid to glutinous stipe that usually tapers to the base and is not distinctly reticulate or glandulose. Singer (1942), who had established *Xerocomus* sect. *Auripori* for *X. gentilis* [≡ *Aureoboletus gentilis*] and other species with golden yellow or bright olive-gold pores, a viscid pileus, and a gelatinous layer on the stipe (with or without a weak veil), later (1947) recombined it as *Pulveroboletus* sect. *Auripori*, which was to form the basis of Pouzar's new genus, *Aureoboletus*. Although not recognized as an independent genus by some mycologists (Corner 1972, Singer 1986, Šutara 2005), *Aureoboletus* has been accepted by others (Watling 1970, Pilát & Dermek 1974, Watling & Largent 1976, Alessio 1985, Dermek 1987, Li & Song 2002, Yang et

al. 2003, Kirk et al. 2008). Recent molecular studies on boletes now support *Aureoboletus* as an independent genus (Binder 1999, Binder & Hibbett 2006, Dentinger et al. 2010, Feng et al. 2012).

Of the twelve species and varieties placed within *Aureoboletus* (Klofac 2010), only two (*A. reticuloceps* M. Zang et al., *Aureoboletus thibetanus* (Pat.) Hongo & Nagas.) have been reported from China (Patouillard 1895, Zang et al. 1993, Ying & Zang 1994, Yang et al. 2003). However, one, *A. reticuloceps,* has been transferred to *Boletus* based on morphological and molecular evidence (Wang & Yao 2005, Dentinger et al. 2010, Feng et al. 2012). Recently, a new species, described here as *Aureoboletus tenuis*, was discovered in Guangxi Province, southern China.

Materials & methods

Specimens were photographed and annotated in the field and then dried in an electric drier. Type specimens were deposited in the Fungal Herbarium (GDGM) of Guangdong Institute of Microbiology, Guangzhou, China. Macroscopic description is based on fresh and dried specimens, field notes, and colour photographs. Colour notations follow Kornerup & Wanscher (1978). For descriptions of microscopic characters (including pileipellis and stipitipellis), tissue sections were revived and examined in 5% potassium hydroxide (KOH) or 1% Congo Red. Thirty basidiospores and 10 basidia were randomly selected from a mature specimen and measured in KOH; Q = spore length/width ratio; Q_m = mean ratio.

DNA was extracted from dried specimens using the Sangon Fungus Genomic DNA Extraction kit (Sangon Biotech Co., Ltd., Shanghai, China) according to the manufacturer's instructions. The large subunit (nLSU) region was amplified by PCR, using primers LR0R and LR5 (Pinruan et al. 2010). The amplified products were determined by electrophoresis on 1% agarose gel against a known standard DNA marker and directly sequenced in Beijing Genomic Institute (BGI). The LSU sequence was submitted to GenBank. These and reference sequences from GenBank were used in phylogenetic analysis after being edited and aligned using Clustal 1.81 (Thompson et al. 1997) and MEGA5.1 (Tamura et al. 2011). The dataset was analyzed with maximum parsimony by PAUP* 4.0b10 (Swofford 2003) following He & Li (2013).

Taxonomy

Aureoboletus tenuis T.H. Li & Ming Zhang, **sp. nov.** Figs 1, 2

MycoBank MB 804773

Differs from *Aureoboletus auriporus* var. *novoguineensis* by its smaller fruitbodies and shorter basidiospores and from *A. thibetanus* by its wrinkled to shallowly reticulate pileus surface and the absence of appendiculate veil remnants.

Type: China, Guangxi Province, Maoʾershan National Nature Reserve, 25°50′N 110°19′E, 1387 m alt., on soil in a broadleaved forest dominated by *Fagaceae* (*Cyclobalanopsis* sp.), 16 July 2012, Ming Zhang (**Holotype**, GDGM 42601, GenBank KF534789).

Etymology: the specific epithet indicates the slender habit of the new species.

Fig 1. *Aureoboletus tenuis* (Holotype GDGM 42601). Basidiomes. Scale bar = 20 mm.

Basidiomes slender. Pileus 20–35 mm broad, hemispherical when young, becoming broadly convex to nearly plane in age, strongly glutinous when fresh, distinctly wrinkled to irregularly and shallowly reticulate, brown to reddish-brown (6D8–8D8, 8E8) at center and gradually paler outwards, deep orange (5A8–6A8), orange (5A7–6A7), orange-yellow (4A8–4A7), light yellow to pale yellow (3A4–4A4) at margin, with a slightly incurved edge when young. Context 3–4 mm thick at the centre of the pileus, thinner at pileus margin, soft, white to yellowish-white (1A1–1A2), more or less brown beneath the pileipellis, slightly changing pinkish-white (7A2–9A2) to pale red (7A3–9A3) when exposed. Tubes slightly depressed around stipe, light yellow to greenish-yellow (2A5, 2B5), 8–10 mm deep, unchanging on bruising. Pores 0.8–1 mm in diam., roundish to angular, somewhat compound and relatively larger around the stipe, concolorous with tubes. Stipe 40–70 × 3–7 mm, central, cylindrical, sometimes hollow and usually tapering towards the base, greyish-red to brownish-orange (7C4–7D4), smooth, without reticulation, sometimes longitudinally striate, gelatinous or strongly viscid, especially when young and wet, with a white (1A1) basal mycelium. Odor none. Taste mild.

Basidiospores (10–)11–12 × 4–5 μm, Q = (2.4–)2.5–2.8(–3), Q_m = 2.75 ± 0.29, n = 30, ellipsoid, smooth, yellowish to yellowish-brown in 5% KOH, thin-walled. Basidia 4-spored, 20–26 × 8–10 μm, clavate, yellowish-white to hyaline in 5% KOH, yellow to yellowish-brown in Melzer's. Sterigmata 2.5–3.5 μm

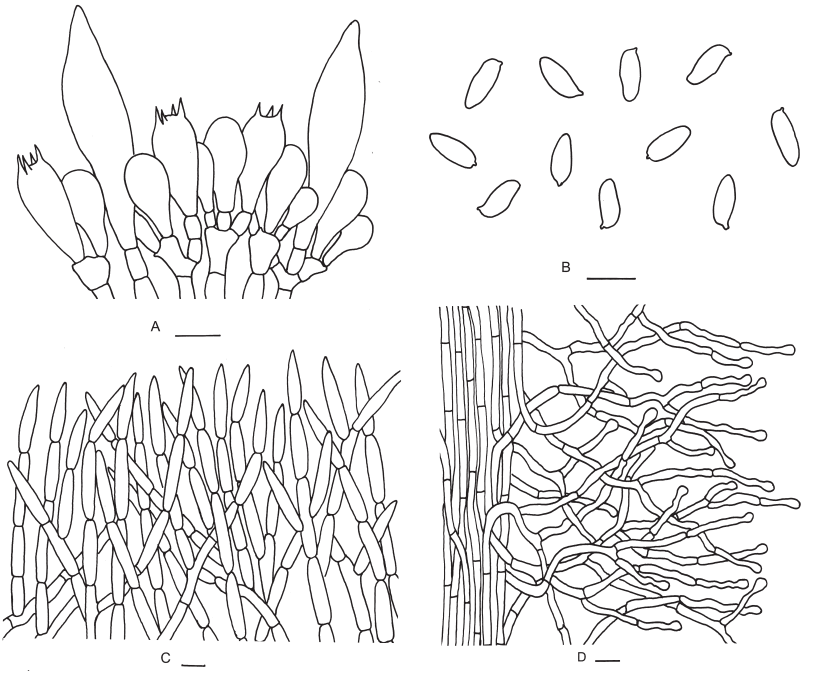

Fig. 2. Microscopic features of *Aureoboletus tenuis* (Holotype GDGM 42601). A. Basidia and pleurocystidia; B. Basidiospores; C. Pileipellis; D. Stipitipellis. Scale bars: A, B = 10 μm; C, D = 20 μm.

long. Pleurocystidia 40–53 × 11–15 μm, fusiform, thin-walled, yellowish-white to hyaline in 5% KOH. Cheilocystidia 42–52 × 11–15 μm, similar to pleurocystidia in shape and size. Hymenophoral trama subparallel to nearly bilateral, yellowish-white to hyaline in 5% KOH, composed of branching hyphae 6–9 μm wide, hardly to only slightly gelatinized. Pileipellis in young material usually an ixotrichodermium consisting of loosely and vertically arranged, frequently septate, thin-walled hyphae 6–12 μm in diam., tending to collapse in mature and dried specimens, yellowish white to hyaline in 5% KOH. Stipitipellis ixotrichodermial, producing branching hyphae 7–13 μm wide, with slightly swollen tips. Caulocystidia not observed. Clamp connections absent in all tissues.

Ecology & distribution — Solitary or scattered on soil in a broad-leaved forest dominated by *Fagaceae* (*Cyclobalanopsis* sp.). Known only from the type locality.

Comments — The diagnostic features of the new species include the small and slender basidiomes, glutinous and wrinkled pileus, cylindrical viscid

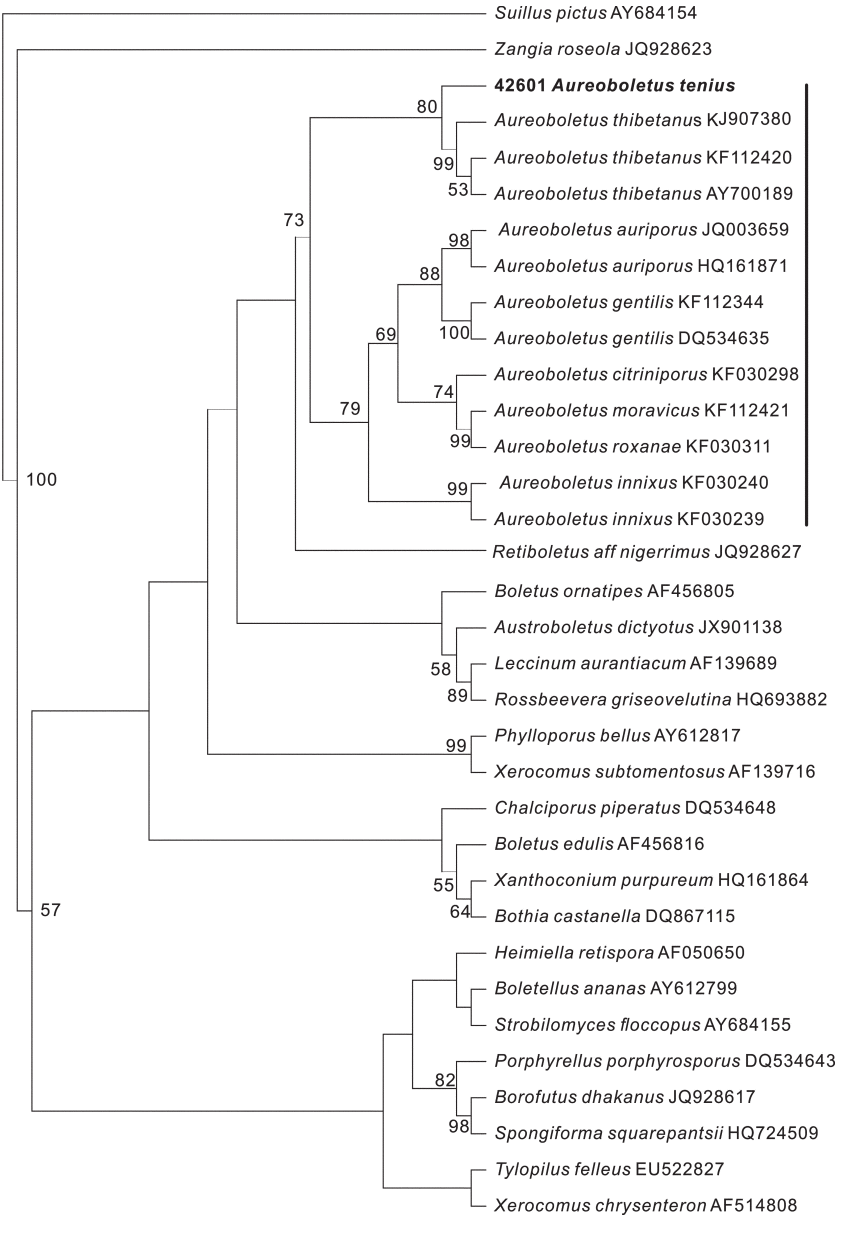

Fig. 3. The phylogenetic tree obtained from Maximum Parsimony analysis of LSU sequences of species of *Boletales*. *Suillus pictus* is selected as outgroup. Parsimony bootstrap values >50% are shown.

and sometimes hollow stipe, and relatively short basidiospores. This unique combination of characters easily separates *A. tenuis* from other *Aureoboletus* species.

Aureoboletus auriporus var. *novoguineensis* (Hongo) Klofac and *A. thibetanus* also have a glutinous and wrinkled pileus. However, *A. auriporus* var. *novoguineensis* differs by its larger and more robust fruitbodies, pale reddish-brown stipe, and longer basidiospores (11.5–15.5 µm; Hongo 1973, Klofac 2010), and *A. thibetanus* differs by its chestnut-brown, rusty-brown to pale brown, more distinctly reticulate-alveolate pileus that is ornamented by strongly gelatinized veil remnants hanging at margin, longer basidiospores (9.0–15.0 × 4.0–5.5 µm), and thin-walled cystidia with a refractive substance on the surface (Patouillard 1895, Yang et al. 2003, Klofac 2010).

Aureoboletus tenuis is easily differentiated from similarly coloured taxa such as *A. flaviporus* (Earle) Klofac and *A. roxanae* (Frost) Klofac, as *A. flaviporus* exhibits more robust fruitbodies and larger basidiospores (11–18 × 4–6 µm; Earle 1904, Both 1993, Bessette et al. 2000, Klofac 2010) while *A. roxanae* has a dry and broader pileus (≤90 mm) and sturdier stipe (≤70 × 16 mm; Frost 1874, Smith & Thiers 1971, Bessette et al. 2000, Klofac 2010).

The phylogenetic tree (Fig. 3) clusters all sampled *Aureoboletus* species in a clade with 73% bootstrap support and *A. tenuis* and *A. thibetanus* in a subclade with a 80% bootstrap value. This well-supported lineage indicates that the new taxon *A. tenuis* is sister to *A. thibetanus*, but the blast result with nrLSU sequence shows that the two species share only 97% max identity. Thus, *A. tenuis* is phylogenetically and morphologically distinct from all the sampled species.

Acknowledgments

Sincere thanks are expressed to Dr. Beatriz Ortiz-Santana (US-Forest Service, Northern Research Station, Center for Forest Mycology Research, USA) and Dr. Matteo Gelardi (Bracciano, Italy) who reviewed the manuscript and provided invaluable suggestions. Thanks are also given to Dr. Vladimír Antonín (Moravian Museum, Department of Botany, Brno, Czech Republic) for supplying and translating literature, to Miss Chao-qun Wang and Dr. Wang-qiu Deng for their valuable suggestions on the manuscript. Acknowledgement is sincerely expressed to Mr. Cheng-shu Qiu for his assistance. This study was supported by grants from the National Natural Science Foundation of China (No. 31170026, 31101592, 31070024, 31093440).

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